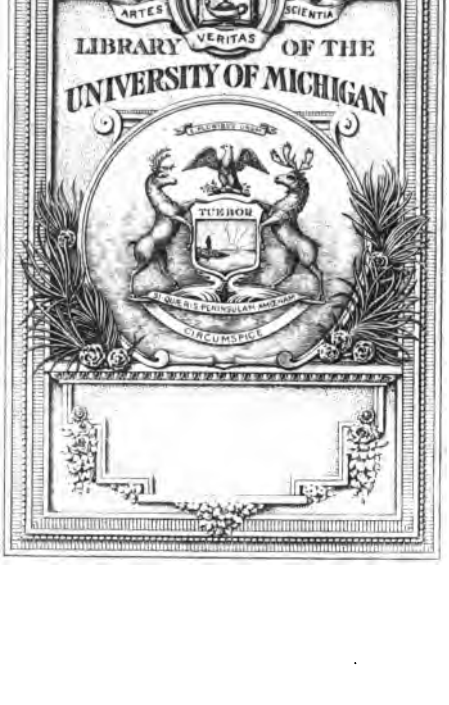
BETTER PLASTERING AND BETTER ACOUSTICS

By Lawrence Hitchcock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A TREATISE
ON
INTERIOR PLASTERING

FOR THE USE OF

ARCHITECTS, OWNERS,
CONTRACTORS

1915

BY
LAWRENCE HITCHCOCK

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FOREGROUND: EAST OHIO GAS COMPANY'S NEW OFFICE BUILDING, CLEVELAND, OHIO. WILLIAM B. TUBBY, ARCHITECT
BACKGROUND: NEW CITY HALL, CLEVELAND, OHIO. J. MILTON DYER, ARCHITECT
BOTH BUILDINGS PLASTERED THROUGHOUT WITH HYDRATED LIME PLASTER FOR SCRATCH AND BROWN COATS

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Parts

List of Illustrations

INTRODUCTION.

INTERIOR plastering is a subject which, like many others, has not been given sufficient attention of late years, with the result that this particular branch of construction has been retrograding rather than advancing.

The object of this book is to point out the factors which should be considered in plastering. The contents are compiled from my own experience as well as that of many well known architects.

If what is written has any tendency to bring the art of plastering up to a higher plane, then its purpose has been accomplished.

LAWRENCE HITCHCOCK.

INTERIOR PLASTERING

IN the construction of residences, office buildings, stores, or any kind of building, the interior plastering is one of the most particular and important parts of the construction. The cost of the material and labor in the plastering contract is only a small percentage of the cost of other contracts, such as the mason's or carpenter's contract, etc., yet to the owner and ultimate occupant of the building it is of the greatest importance. This is because it is that part of the construction with which one comes in daily contact, and it is the interior plastering of the building that largely determines the noisiness due to the reflection and transmission of sound.

In all building construction there is a great amount of work in which there is no common interest between architect, engineer and owner, such as the strength of beams, type of construction, etc. These are features which have to be left entirely to the architect and engineer because they are subjects regarding which the owner usually knows very little. The plastering, however, is the feature regarding which there should be a common interest because it is of such vital importance, and being that part of the building so much in evidence and a subject so simple that it should be readily understood by everyone.

GROUNDS FOR PLASTER The plastering on the interior walls and ceilings is generally from ½" to ⅞" thick, measuring from the inside surface of the lathing against the studding to the outside surface of the plaster. This is what is called the thickness of the grounds. This thickness varies according to the quality of the job; that is, a building in which the grounds are ⅞" thick is productive of much better finished walls than one in which the grounds are ½" or ⅝" thick. Where metal lath, wood lath or plaster board are used as the material on which to plaster, the thickness of the grounds includes the thickness of the lath or plaster board embedded in the plaster. Plaster adheres to wood lath because of the clinch of the material in the openings between the lath. It adheres to brick, tile or plasterboard because the suction of these materials draws minute particles of plaster into the voids of the brick or tile, etc., eventually hardening and making a complete bond.

The plastering of a wall generally consists of three coats or thicknesses, each of which is put on in rotation.

SCRATCH COAT — The first coat to be applied to the lath, tile or brick, or other backing material, is called the first, or scratch coat. It derives this name from the fact that its surface is scratched with a rough brush or comb before it finally hardens, so that the next coat, termed the brown coat, will have a complete bond. The scratch coat, when put on wood or metal lath, is pressed hard enough so that the plaster goes through the opening in the lath and just covers it, forming a clinch around the lath. This clinch is known as the "key." On brick, tile or plasterboard, as explained before, the scratch coat cements to the surface and does not require a key as when plastering upon wood or metal lath.

BROWN COAT — The next coat to be applied is the second, or brown coat. It is termed the brown coat because it generally contains more sand than the scratch coat and so is of a brownish hue. It is used to fill the space between the scratch coat and the face of the grounds and to straighten the walls in such a manner that the third, or white coat may be applied as thin as possible. The scratch and brown coats are commonly known as base coats. The third coat, known as the finish, or white coat, is then applied.

WHITE COAT — This third, or finish coat, is very thin, from 1/16" to 1/8" in thickness, and for this reason it is often called the skim coat. Practically throughout the entire United States the white, or third coat consists of a putty made from either lump lime or from a finishing hydrated lime. To this putty the plasterer generally adds, after the putty is placed on the mortar board, about 25% of calcined plaster and also sprinkles in a little sand. Calcined plaster is added so as to counteract the shrinking of the lime in drying, which would otherwise appear in the form of small cracks, called checking. Checking will also occur if the plasterer does not wet and trowel the white coat thoroughly when applying. This shrinking can also be overcome by putting in a very large percentage of sand, making it of about the same consistency as the scratch and brown coats. In certain parts of the United States this heavy sanding of the white coat is practiced, but it is a great exception and not so satisfactory as the addition of calcined plaster.

SAND FLOAT FINISH — Heavy sanding of the white coat is similar to what is known as sand finish, which is more commonly used, and consists of lime putty and sand, to which is added the usual amount of calcined plaster. The sand finish is applied in the same manner as the white coat, except that the surface is floated with a wooden float, giving a rough, sandy effect. A sand finish is generally tinted, while a white coat finish is more often papered.

SECOND NATIONAL BANK BUILDING, TOLEDO, OHIO
D. H. BURNHAM & CO., ARCHITECTS
PLASTERED THROUGHOUT WITH HYDRATED LIME PLASTER FOR SCRATCH AND BROWN COATS

THREE COAT WORK — In plastering work of the best quality the scratch coat is allowed to dry and harden before the brown coat is applied. The brown coat is then applied and, finally, the white coat, so that three distinct and separate coats are applied. This is known as three coat work and is the manner in which the best type of plastering is done.

TWO COAT WORK — In a great deal of work, however, where time cannot be allowed for the scratch coat to dry, and if the job is not a particular one, the brown coat is applied by what is known as the "doubling up" process. This consists of applying the scratch coat on the wall for four or five feet and then immediately, and before the scratch coat has hardened, spread the brown coat on the wet scratch coat, doing the two coats practically in one operation, leaving only the white coat to be applied afterwards. This is what is known as two coat work, as the scratch and brown coats, being applied in one operation by the so-called "doubling up" process, makes one coat, so that when the white coat is applied the work is completed in two coats, and is so termed two coat work.

ONE COAT WORK — In some cases, with a view in mind of economy, the white coat is omitted, and the scratch and brown coats are applied by doubling up, as just described. Work of this character is known as one coat work. One coat work can be done only with lime plaster, as it is necessary to float the surface smooth to have an appearance such as that obtained when sand finish is applied. Gypsum plaster hardens so quickly as to make it impossible to level and float the surface and so do one coat work.

OLD FASHIONED LUMP LIME PLASTER — For the scratch and brown coats, or base coats, until the last ten or fifteen years, a plaster was made by mixing together lump lime putty, sand and hair. Plaster made with these ingredients produced very high grade results. No objection was ever found to the quality of an old lump lime plaster job when it was well done. The objection, however, in using lime for scratch and brown coat work was the same as in the case of using lump lime putty for white coat. There was danger that the lump lime, in being slaked or run off, would not be put through a screen of sufficient fineness, nor the putty aged a sufficient length of time, which, in the case of some limes, required two or three months. Screening through the finest sort of a screen and thorough aging was necessary to prevent pitting and popping due to the presence of unslaked particles of lime.

Besides this danger, which occurred only in rather exceptional cases, was the great expense, trouble and time required in running off

a lump lime putty and soaking and mixing it with sand. It would generally mean that large mortar boxes had to be used and enough lime run off for the whole job at one time, then allowing the putty to soak for days and weeks. Slaking the lime, and mixing the sand and hair with it, was often carelessly done by the laborers, so that when a new commodity which overcame these labor and mixing troubles appeared on the market, it rapidly superseded the lump lime plaster in a large part of the country.

GYPSUM HARD WALL PLASTER

The new plastering material was known as gypsum hard wall plaster. There are innumerable objections to the use of gypsum hard wall plaster for interior plastering, and the only reason it has reached its prominence is due to the speed and ease with which it may be mixed and put on the wall. Its merit lies in this alone and not in the quality of the material or the job produced, because the quality of the finished job is very much inferior to an old fashioned lump lime plaster job. This fact is easily established by the practice, still followed, and conditions in other countries where the saving in time and labor is not allowed to offset the cheapening of the quality of the finished job. For instance, in England there are enormous gypsum deposits of the purest and highest quality and which would produce a very much better gypsum hard wall plaster than is produced in this country, but there is practically no gypsum mined or calcined in England, because the English architects and home owners will not tolerate the serious objections that are to be found in finished gypsum hard wall plaster jobs. It is much preferred in England to continue the use of lump lime plaster and it is almost universally used in that country. What is true in England is also true of several continental countries.

OBJECTIONS TO GYPSUM HARD WALL PLASTER

The greatest objection to gypsum hard wall plaster for interior plastering is due to its making such a brittle and hard wall that it reflects and transmits sound very much more readily than a wall that is made with lime plaster. Buildings plastered with lime plaster do not reflect and transmit sound the same as buildings plastered with gypsum hard wall plaster. The question of sound-proofing buildings never had to be studied as is done at present until gypsum hard wall plaster became extensively used. This was because the lime plaster in drying hardened in a porous condition, containing innumerable minute dead air cells, which proved an effective and permanent retarder of sound. Even though deadening felt and the most costly class of construction be used, there will continue to be reflection and transmission of sound if the plastered walls are constructed of gypsum hard wall plaster.

The gypsum manufacturing companies of the United States have devoted great amounts of money and much time trying to overcome this serious objection to gypsum hard wall plaster. Their experiments have consisted of adding percentages of asbestos fibre, wood fibre, lime, etc. This has, however, been of no avail, because with gypsum hard wall plaster this characteristic is inherent. A hard, brittle wall, such as that made with gypsum hard wall plaster, is not necessary for plastering purposes. Old lump lime plaster, which was universally used for plaster until a period of ten or fifteen years back, was sufficiently strong to withstand all normal conditions of wear imposed. This has been demonstrated an indefinite number of times by examination of the plaster in many of the buildings erected even over a century ago, which buildings are still standing with the plaster in an excellent state of preservation. When extreme hardness is a desirable feature in an interior plaster, it is now customary to add Portland cement to the lime mixture which makes a plaster even harder and more brittle than gypsum hard wall plaster. In using hydrated lime plaster in places where sound reflection and sound transmission are not important features, such as warehouse or store construction, Portland cement is very frequently added to the plaster, but for all other classes of construction, such as residences, apartment houses, office buildings, schools, churches, hospitals, etc., extreme hardness of the walls and the resulting resonance or sound carrying capacity, is to be avoided in every way possible.

Another serious objection to a finished wall made with gypsum hard wall plaster is the fact that this material begins to set and harden so quickly after the material is mixed with water and ready for application, that a plasterer finds it exceedingly difficult to straighten and true the walls, and as a result they are often left with a wavy and uneven surface.

RESEARCH WORK TO FIND A BETTER PLASTER

These two serious objections to gypsum hard wall plaster, together with many other objections of a minor character, and which are mentioned later in this book, created a demand by architects and building owners for a material that did not have these objectionable features and disadvantages. The well known old lump lime plaster was accepted as the desirable basic material for an ideal plaster.

Experiments undertaken to produce the much desired material were along the line of overcoming the objections in slaking, mixing, and in the danger of pitting and popping, as were sometimes the case in the use of lump lime; that is, a material that would produce the satisfactory results given by old fashioned lump lime with the mechanical

West Penn Hospital, Pittsburgh, Pa
J. L. Beatty, Architect
Plastered Throughout With Hydrated Lime Plaster for Scratch and Brown Coats

troubles of preparing and mixing eliminated, was looked upon as the material to meet the requirements of an ideal plaster. These objections were finally overcome by developing and perfecting a plaster in which hydrated lime was used as the active ingredient rather than lump lime or calcined gypsum.

HYDRATED LIME PLASTER

In the manufacture of hydrated lime all the slaking and mechanical preparation of the lump lime, which work has been done in the past by the laborer at the building site, is now finished at the manufacturing plant under the direction of skilled chemists and by the use of machinery which insures an absolutely uniform and thorough hydration of the lime, as well as the removal of all free lime and all impurities. The elimination of these operations prevents the troubles that were met with in the use of lump lime on the job. By the use of hydrated lime, a building can be plastered, the finished work having all of the advantages of old lump lime plaster, and the materials can be mixed as readily as gypsum plaster.

PROPORTIONS FOR HYDRATED LIME PLASTER

The proper proportions for interior plastering work should consist of one pound of hydrated lime with 3½ to 4½ pounds of sand, depending upon the quality of the sand. This is standard practice and can be used with confidence for all classes of interior plastering, whether it is to be applied to brick, tile, wood lath, metal lath or other forms of wall construction. In some cases, however, the above proportions may be varied. For instance, where three coat work is followed it is not necessary to have the brown coat quite as rich in hydrated lime as the figures mentioned above, and the sand may be mixed in proportions as high as five pounds of sand to one pound of hydrate. When plastering on brick or tile walls, the proportion of sand for the scratch coat may be slightly greater than the quantity used when plastering on wood or metal lath, but the maximum of 4½ pounds of sand to one pound of hydrate should not be exceeded for any scratch coat work.

When lime plaster is being applied by the plasterer, it is very easy to learn whether it is too rich or too poor; that is, whether it requires more or less sand. When a lime mortar shows slight cracks in drying, it is an indication that it is being applied too rich in lime and should have more sand added. It is common practice to make the scratch coat a little richer than the brown coat.

Later in this book is found complete specifications covering the mixing and application of hydrated lime plaster for all classes of present day construction. See Pages 31 to 37.

METHODS OF MIXING An interior plaster composed of hydrated lime, sand and hair can be mixed in two ways. These three ingredients may be mixed (a) in the sanded form in which case the hydrated lime, sand and hair are mixed at a regular mixing plant and delivered to the job prepared, requiring nothing further than the addition of water and wetting up, or (b) on the job in what is known as the neat form, in which case the lime, sand and hair are delivered separately on the job and the mixing done there.

SANDED MATERIAL Usually a better job can be done when the neat materials are mixed at a mixing plant and the plaster delivered on the job in the sanded form. This is due to the more uniform proportioning and mixing of the materials by machinery at the mixing plant than can possibly be obtained at the building site.

NEAT MATERIAL When it is desired to follow the method of mixing mentioned under (b) the best method is to add sufficient water to the hydrated lime in an ordinary mortar box to make a thick soup. The hair is then sprinkled in and followed by a sufficient amount of sand to bring the mixture to the proper consistency for application. This method produces an ideal mixture with a minimum amount of hoeing. It will readily be seen that the lime in its creamy form will mix with the sand in a manner that will produce very much better results than when the materials are mixed in their dry form. It is usually difficult to separate the hair when dry, and for this reason the hair is first soaked in water so that it may become thoroughly separated. When the hydrated lime has been brought to a creamy consistency by the addition of water, the hair is sprinkled in and floats through the creamy mixture without segregating. On very large jobs, a small power driven hair picker can be used to advantage to separate the hair.

This method of adding water can be followed only with hydrated lime and is an advantage over the dry method, which must be followed in mixing gypsum hard wall plaster with sand on the job. In very large operations, such as office buildings, where there is a large amount of plastering to be done and where the neat materials are mixed on the job, the hydrated lime, sand and hair can all be mixed in a mechanically driven mixer of the regular mortar mixing type. The water can be added in the mixer and the material prepared for application, and then taken to the rooms where the plaster is to be applied. In some instances the materials are mixed dry in the mechanical mixer and the mixture is then taken to the rooms where the plasterers are working, where it is brought to the proper consistency for application by adding water in a regular mortar box.

MIXING SANDED PLASTER

On jobs where a prepared plaster is specified, that is, the hydrated lime, sand and hair have been thoroughly mixed at a regular mixing plant, it is only necessary to mix the prepared material with water and this may be done either in the regular mortar box or in a mechanical mixer. The mixing in this case is required only to wet the material and bring it to the proper consistency.

Whether the hydrated lime be used in the neat form, or in the sanded form, as soon as the material has had water added and has been thoroughly mixed it can be used at once for plastering. It is not necessary to soak the material over night, or for weeks and months, as was necessary with lump lime. The process of thoroughly hydrating the lump lime having been completed at the manufacturing plant, it is only necessary to make the water addition before using the material. It has been found to be good practice to keep two mortar boxes on the building site, using the mixed material from one while additional material is being mixed in the other. By allowing the material to soak a short time in one box while drawing from the other, it very often makes a more easily spreading mortar.

HAIR, FIBRE, ETC.

Hair, or a substitute for hair, such as fibre, is mixed with the plaster, whether it is hydrated lime plaster or gypsum hard wall plaster, and practically always in the scratch coat when the plaster is put on wood or metal lath. The object of using hair is to have it act as a binder to hold the plaster into the meshes of the lath until such time as the plaster has an opportunity to set and harden. If hair was not used in this coat it would be almost impossible for the material to adhere to wood or metal lath. When the plaster is placed directly on tile or brick there is very little need of hair, and, if it is used at all, only about 25% of what is used on lath is required. Hair or fibre is only necessary in the scratch coat in plastering. The use of hair, or a substitute, however, improves the plaster slightly, and gives to it a little more body and for this reason it is often used in the brown coat. This practice is not necessary, but where it is customary to do so the percentage of hair used is very small.

The proper proportions for the use of hair are shown under "Specifications for Hydrated Lime Plaster," pages 31 to 37.

The kind of hair most suitable for plastering is goat hair. This, however, is difficult to obtain. The next most suitable hair is considered a long, clean grade of cattle hair. This class of hair is the one which is used almost universally. The price of a long, clean grade of cattle hair is gradually becoming higher and the present price makes its

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use expensive for plastering purposes. There are two substitutes for this material, which are known as cottonwood fibre and cocoa fiber, the latter being a fibre which is obtained from the cocoanut. Due to the fact that there are not nearly as many strands of fibre as there are hairs to a pound, it is necessary to use a larger number of pounds of these substitutes per ton of sanded material, the increased quantity by weight sometimes running as high as three times the amount of hair.

Though there is an increase in the number of pounds of cottonwood or cocoa fibre, the total cost of fibre per ton of sanded goods is generally considerably less than the price for the proper grade of hair. A long cattle hair makes a much better wall, however, and is therefore a more desirable material to use when compared with either cottonwood or cocoa fibre.

ADVANTAGES IN THE USE OF HYDRATED LIME PLASTER OVER GYPSUM HARD WALL PLASTER.

SOUND DEADENER The main advantage is the fact that a wall made with lime as a base tends to deaden sound and does not reflect or transmit it in the way that a wall made with gypsum hard wall plaster does.

STRAIGHT WALLS AND ANGLES The second great advantage in quality is the fact that lime plaster does not harden within the short time that gypsum hard wall plaster does. Gypsum hard wall plaster undergoes its initial set after having water added in about a half hour but is held back by the action of retarders so as to set finally in from one and one-half to two hours. This is so fast that in a great many cases it is impossible for a plasterer to straighten the walls and true them up in the manner he should and the walls are often left uneven and wavy. It is impossible to overcome this rapid set in a gypsum plaster because when an excess quantity of retarder is used the gypsum plaster is over retarded, and this "kills" the material, thus losing its strength by preventing the gypsum from setting. Hydrated lime plaster remains soft a sufficient length of time to enable the plasterer to use the float and straighten the walls, angels, etc. If one or two walls of a room are not floated immediately, the walls will not be ruined by being wavy and uneven, as floating may be done several hours after being applied.

These two advantages have been mentioned earlier in this book, particularly the first advantage of sound deadening, which is the greatest means of comparison between the two plasters.

CORROSION OF METAL LATH Another question of importance in regard to difference in quality between the two materials is the fact that a gypsum plaster, when used on metal lath, is very liable to corrode the lath, even though it may be coated and of a galvanized variety, while hydrated lime plaster is a preservative of lath and does not cause corrosion. Gypsum hard wall plaster contains a very high percentage, over 35%, of sulphuric acid. This sulphuric acid is not active upon the lath except when the plaster is in a damp or moist state. When the plaster is to be applied to the lath in the soft mortar form, the acid is active, and corrosion immediately begins to a very high extent. Also, if

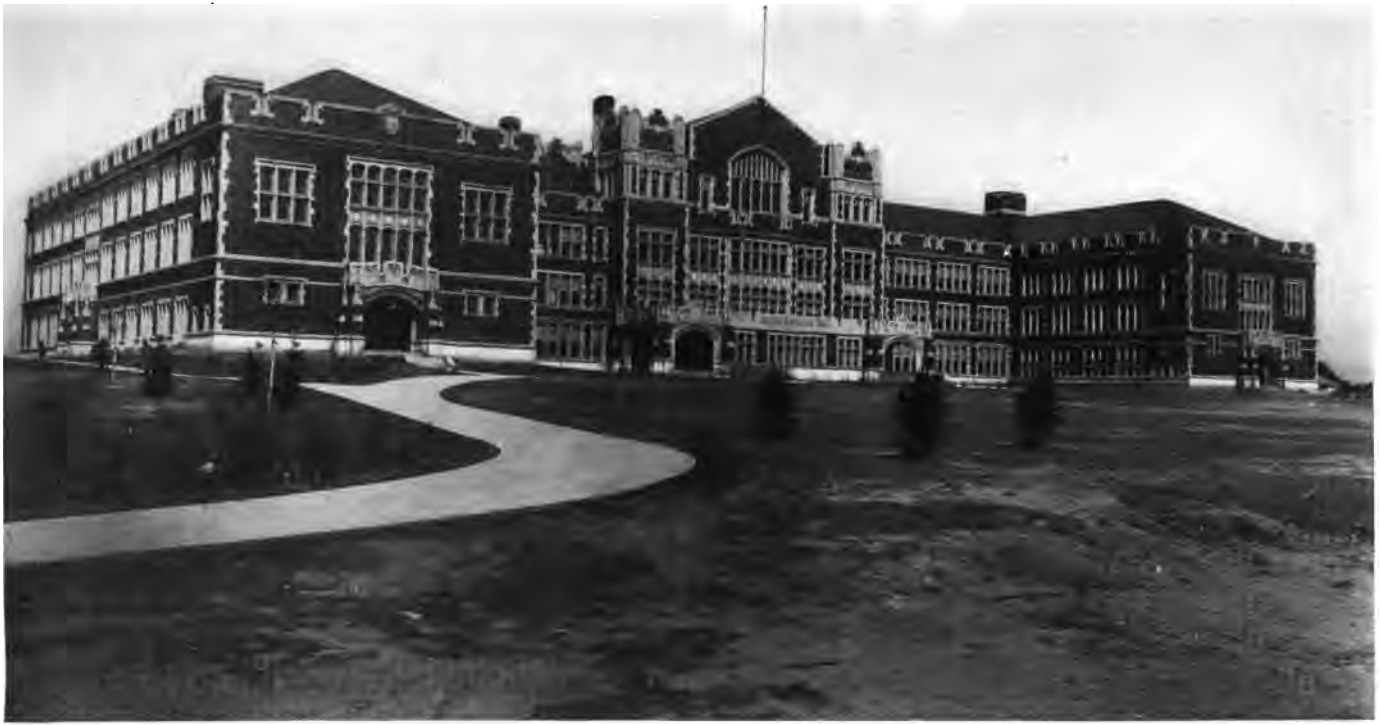
after the wall has been finished, there is dampness or humidity in a building, the sulphuric acid action is started. Where there have been leaks in plumbing and water finds its way to the plaster, the acid action is started and is so effective that in a short time the lath will be absolutely rusted and worthless. There are one or two theories as to how the sulphuric acid is liberated in a gypsum plaster under these moist conditions, and chemists have disputed whether or not an electric action is started, besides the acid effect. It is a well known fact, however, that corrosion does occur.

BUCKLING OF WOOD LATH

Buckling is due largely to the quality of the laths and the manner in which they are nailed. Although this difficulty originates with the lath, the difference in the finished plaster surface when hydrated lime plaster is used is very marked.

Buckling of lath is occasioned by the expansive action of the lath due to the absorption of moisture upon application of the plaster. If the laths are placed too close together, expansion continues to a point where the laths are touching, and expansion from that point on is not followed along natural lines, the expansion forcing the laths outward so that cracking of the plaster occurs, and in some cases if a lath should not be securely nailed the whole end of the lath forces its way through the plaster. Also a crooked lath is often, by distorting its natural shape in nailing, liable, when it absorbs the moisture from the plaster, to pull the nail out and return to its natural shape.

The result of buckling is a wavy and uneven surface of the finished walls. This may be largely overcome by having the laths spaced a full ¼" apart and by being firmly nailed to each stud. Spacing the laths this distance will assist in eliminating buckling and will also allow sufficient key for holding the plaster. Several hours are required for the expansive action of the lath to become complete. Gypsum plaster, as mentioned previously, sets and hardens within two or three hours, and the expansion of the lath continues after the gypsum plaster has set, causing lath cracks and buckling, which action takes place after the plaster has become so hard that it is impossible to make true and even surfaces in some cases without replastering. The expansive action of the lath acts in the same manner when hydrated lime plaster is used, but the slower hardening properties of this material allows the plasterer to float the surfaces after the expansive action is complete and to remove the wavy and uneven appearance, leaving the surface a true and even plane.



MORRISON R. WAITE HIGH SCHOOL, TOLEDO, OHIO
D. L. STINE, ARCHITECT FOR BOARD OF EDUCATION
PLASTERED THROUGHOUT WITH HYDRATED LIME PLASTER FOR SCRATCH AND BROWN COATS

FIRE RESISTANCE

Neither hydrated lime plaster nor gypsum hard wall plaster is a fireproof material. They should be classed as fire retarders, and in this class they have about an equal value. It requires a temperature of 1200 degrees Fahrenheit to decarbonize a lime stone, while on the other hand gypsum calcines at 375 degrees Fahrenheit. Hydrated lime plaster, composed of hydrated lime with a percentage of Portland cement, makes an ideal fireproof plastering material, and where this class of plaster is desired, it should be used. Portland cement and gypsum hard wall plaster do not combine, so that it is impossible to make a plaster with gypsum as a base that would be an absolutely fireproof material.

PLASTERING ON CONCRETE

When it is desired to plaster directly on concrete, a plaster made with lime as a base is the best material for this purpose. Gypsum plaster cannot be applied to concrete with any degree of certainty of its sticking. In order to secure the best results when using hydrated lime plaster on concrete, it is advisable to have the form boards in which the concrete is placed fairly rough, and when the concrete is perfectly dry it should be washed with a solution of muriatic acid and water, and then brushed thoroughly with a wire brush. This removes the filmy surface which is found on nearly all concrete work.

DECORATING ON PLASTER

If tinting or decorating is put directly on gypsum hard wall plaster a sizing coat is required, as the acid in the gypsum, as well as acids in some of the retarders used in the manufacture of gypsum plaster, decomposes the coloring matter in the decorating. On the other hand, hydrated lime plaster does not require the sizing coat as there are no injurious acids or retarders used in the manufacture of this material. It is customary, however, to apply paints and tinting on lime, as the finishing coat in nearly all buildings is of a lime base, either a lime putty finish or a lime sand float finish, regardless of what the scratch and brown coats may be. Some of the oldest paintings in Europe have been painted directly on lime plaster and are still in an excellent state of preservation. This is the best possible demonstration that lime plaster has the property of holding paints and tints when decorated in this manner.

ECONOMIC ADVANTAGES OF HYDRATED LIME PLASTER

Either hydrated lime plaster or gypsum hard wall plaster may be delivered in neat or sanded form at the job, one carrying no advantage over the other as regards the time required to mix with water and apply to the wall. Both materials overcome the difficulties in slaking and working old fashioned lump lime plaster. The economy, however, in the use of hydrated lime over gypsum hard

wall plaster is quite marked in several ways. The principal economic advantage is the fact that a ton of neat hydrated lime has a much greater sand carrying capacity than a ton of neat gypsum. In other words, a ton of hydrated lime, when sanded, will produce a much greater quantity of plaster. The majority of neat gypsum plasters have a sand carrying capacity of from two, to two and one-half parts of sand by weight. This would make a yield of from three, to three and one-half tons of sanded gypsum plaster from one ton of neat gypsum. Hydrated lime will carry from three and one-half to four and one-half parts of sand by weight, and sometimes five parts may be added. Thus it will be seen that one ton of hydrated lime produces a yield of from four and one-half to six tons of sanded hydrated lime plaster.

COVERING CAPACITY The covering capacity of either material when mixed and sanded is practically the same; for instance, if it is desired to plaster directly on a tile surface and the grounds are ¾", it will require the same amount of either material, as the volume to be filled will be the same in either case; as the bulk of either material is determined by the amount of sand in a ton of plaster. The hydrated lime or the gypsum practically just fills the voids in the sand. The fact that a ton of neat hydrated lime will make a much greater yield of sanded plaster determines the economy. In some sections of the United States the cost of hydrated lime per ton is slightly higher than a ton of neat gypsum plaster; the difference, however, in the sand carrying capacity between the two materials more than equalizes the initial cost per ton of hydrated lime.

PLASTER DROPPINGS On all jobs of plastering there is found more or less plaster which has dropped to the floor while the material was being applied, the amount of droppings varying with the size of the job. These droppings are a loss to the plastering contractor when gypsum plaster is used, as they become so hard after remaining on the floor an hour or two that it is impossible to retemper and use them. With hydrated lime plaster, however, the droppings may be scraped up, retempered, and used with absolutely no loss in material. It will readily be seen what a vast saving in material will be made, particularly on a large job, where hydrated lime plaster is used. The droppings, when using this material, may be scraped up either at night or the following morning, and, upon retempering (wetting up), the material will have its original properties, the same as if it had been newly mixed. Hydrated lime plaster hardens only after it has been spread out on the wall so that air can penetrate the surface. The same loss in material also applies to gypsum plaster that may have remained in the mortar box

or on the mortar board for several hours after it was mixed, the setting action of the material being so quick that the material is of no value unless used immediately after mixing, and a loss in material is very often incurred by conditions arising on a job which make it impossible to use all the gypsum hard wall plaster that may have been wet up.

It may also be stated that neat hydrated lime is a more stable material than neat gypsum hard wall plaster. Neat gypsum plaster deteriorates after a few months, and particularly in warm weather, the result being that a plaster made with neat gypsum that has become old does not have the proper working qualities and works short under the trowel. Neat hydrated lime, on the other hand, does not deteriorate with age, and it may be stored for months without loss or without affecting the working qualities of the plaster.

ECONOMY IN WHITE COAT

The amount of hydrated lime required for the finish coat is determined by the condition in which the brown coat is finished. If the brown coat is wavy and uneven, it will readily be seen that a much larger amount of hydrated lime is required for the finish coat, as it is necessary to use enough material to bring the uneven brown coat to a true and even surface. Consequently, the brown coat should be left straight and even in order to economically apply the finish coat. It has already been pointed out that the use of hydrated lime plaster for scratch and brown coats eliminates the uneven surface which is usually found where gypsum plaster has been used, and it will therefore be seen that by the use of hydrated lime plaster the finish coat may be applied with much less material.

SPREADING QUALITIES

One of the first requisites a plaster must have in order to produce a good finished job, is the ease with which it may be worked under the trowel. Hydrated lime has the property of being easily worked, and is the most plastic of any of the present known plastic materials. This is evidenced by the fact that hydrated lime is used for nearly all finish coat plastering. This ease of working is not quite so noticeable in the use of hydrated lime for scratch and brown coat work, owing to the large amount of sand in the mixture, though it is a much more easily worked material under the trowel than gypsum hard wall plaster. In fact, it has become customary for a great many mixing plants to add a percentage of hydrated lime to gypsum plaster to produce the property of being easily spread under the trowel and to offset the poor working properties of gypsum plaster. The addition of hydrated lime to gypsum plaster brings about a more plastic material so that it is worked with less physical effort; this addition, however, does not produce the same spreading properties as carried by a plaster made with hydrated lime as a base.

DRYING AND HARDENING

Gypsum hard wall plaster hardens by chemically recombining the water used in wetting it up, and, in this way, replaces the water that was originally driven off when the gypsum rock was calcined.

Lime hardens when it is spread out on the wall, by absorbing from the air the carbon dioxide which was driven off from the limestone when it was burned, and in this way it returns to the same composition as the original limestone from which the lime was burned.

As has been previously stated, it was necessary, when using lump lime for plastering purposes, to slake and allow the putty to age in the mortar box for days, and even weeks, before using it. This method of handling lump lime has given a somewhat general impression that any building, plastered with any kind of lime, requires considerable time for the plastering to be finished so that other construction work on the building can be carried forward. Plastering today, however, can be finished just as quickly with hydrated lime plaster as with gypsum hard wall plaster.

Either material just requires wetting up before applying to the wall. Neither requires longer preparation in this respect than the other. After application is made on the wall, the difference in length of time in drying and hardening is not so great as to make any material difference in the time required to finish the job.

In all plastering, the work is rotated, i. e., in three coat work, the scratch coat is put on, then the brown coat and then the white coat, and a plasterer is putting on one of these coats in one place while the wall is hardening in another place, just previously done. He continues his work until the original place is hardened, when he goes back and puts on the next coat. By this rotation process it makes no difference in the final time for finishing the job. At the outside, under the most unfavorable conditions, it would only make a difference of from twenty-four to forty-eight hours in the completion of the building. In a large part of the year, i. e., in spring, summer and fall, when most plastering is done, lime plaster dries out and hardens rapidly. In the winter time, when the building being erected is kept dried out by a furnace, as is customary, there is also no trouble in the rapid drying and hardening of the lime plaster.

Under favorable conditions, jobs of lime plastering have been done, in which the scratch coat is put on in the morning, the brown coat in the afternoon, and the white coat the following day. Under the most unfavorable conditions, and particularly on metal lath, sometimes the scratch coat is gauged with not over five per cent. of calcined plaster to hurry the set and hardening, so that any unnecessary delay in the rotating of the coats is avoided.

H. K. Wick Residence, Youngstown, Ohio
Abram Garfield, Architect
Plastered Throughout With Hydrated Lime Plaster for Scratch and Brown Coats

Standard Specifications
for
Hydrated Lime
Plastering

Applying to Wood Lath—Three Coat Work

Where plaster is mentioned, it shall mean a mixture of hydrated lime and sand in proportions and applied as mentioned below.

The hydrated lime shall be of an approved brand and shall pass the Standard Specifications for Hydrated Lime of the American Society for Testing Materials.

Where wood lath is mentioned, it shall mean ⅜" x 1½" No. 1 Spruce, Hemlock or White and Norway pine lath, free from knots, sap, bark or other imperfections.

Lathing is to be put on a full ¼" apart and nailed with 3d nails well driven flush with lath. If the lath are dry, sprinkle same with water before applying the plaster.

Grounds to be ⅞".

SCRATCH COAT

Apply the scratch coat lightly, but with sufficient pressure to obtain a good clinch. Scratch the face to strengthen bond for brown coat. When this coat is thoroughly dry apply the

BROWN COAT

Use enough material to bring out to grounds. Darby and float the entire surface to obtain a true and even plane ready for finish coat.

FINISH COAT—WHITE*

Bring the putty to the proper consistency for application and trowel to a perfect finish, keeping the surface moist.

FINISH COAT—SAND*

After applying the material, use the brush and float well to cause the surface to present a characteristic sandpaper finish.

†*The following are the proportions in which materials should be mixed at the mixing plant or by the contractor on the job for wood lath—Three coat work.*

Per Ton of Sanded Plaster	Per Hundred Pounds of Hydrated Lime
SCRATCH COAT	
1550 pounds sand	350 pounds sand
450 pounds hydrated lime	100 pounds hydrated lime
3½ pounds hair	¾ pound hair
BROWN COAT	
1600 pounds sand	400 pounds sand
400 pounds hydrated lime	100 pounds hydrated lime
1½ pounds hair	⅜ pound hair
FINISH COAT—WHITE	
Lime putty properly gauged with Plaster of Paris	
FINISH COAT—SAND	
1450 pounds sand	275 pounds sand
550 pounds hydrated lime	100 pounds hydrated lime

*Incorporate paragraph referring to either white finish or sand finish, according to finish desired.

†These are average mixtures for first class, clean, sharp plastering sand. Mixtures may be changed to meet other qualities of sand.

Applying to Wood Lath—Two Coat Work

Where plaster is mentioned, it shall mean a mixture of hydrated lime and sand in proportions and applied as mentioned below.

The hydrated lime shall be of an approved brand and shall pass the Standard Specifications for Hydrated Lime of the American Society for Testing Materials.

Where wood lath is mentioned, it shall mean ⅜" x 1½" No. 1 Spruce, Hemlock or White and Norway pine lath, free from knots, sap, bark or other imperfections.

Lathing is to be put on a full ¼" apart and nailed with 3d nails well driven flush with lath.

If the lath are dry, sprinkle same with water before applying the plaster.

Grounds to be ⅞".

FIRST COAT

Apply a thin coat to make a good, durable clinch, then bring out to grounds by doubling up on the thin coat. Use darby and float to bring to a true and even surface ready for the finish coat.

FINISH COAT—WHITE*

Bring the putty to the proper consistency for application and trowel to a perfect finish, keeping the surface moist.

FINISH COAT—SAND*

After applying the material, use the brush and float well to cause the surface to present a characteristic sandpaper finish.

†*The following are the proportions in which materials should be mixed at the mixing plant or by the contractor on the job for wood lath—Two coat work.*

Per Ton of Sanded Plaster	Per Hundred Pounds of Hydrated Lime
FIRST COAT	
1550 pounds sand	350 pounds sand
450 pounds hydrated lime	100 pounds hydrated lime
3½ pounds hair	¾ pound hair
FINISH COAT—WHITE	
Lime putty properly gauged with Plaster of Paris	
FINISH COAT—SAND	
1450 pounds sand	275 pounds sand
550 pounds hydrated lime	100 pounds hydrated lime

*Incorporate paragraph referring to either white finish or sand finish, according to finish desired.
†These are average mixtures for first class, clean, sharp plastering sand.
Mixtures may be changed to meet other qualities of sand.

Applying to Metal Lath—Three Coat Work

Where plaster is mentioned, it shall mean a mixture of hydrated lime and sand in proportions and applied as mentioned below.

The hydrated lime shall be of an approved brand and shall pass the Standard Specifications for Hydrated Lime of the American Society for Testing Materials.

Grounds to be ¾".

(Metal lath to be kind and grade designated by the architect.)

SCRATCH COAT

Apply the scratch coat lightly, but with sufficient pressure to thoroughly embed the metal lath in the plaster. Scratch the face to strengthen bond for brown coat. When this coat is thoroughly dry apply the

BROWN COAT

Bring this coat out to grounds and use the darby and float to form a true and even surface ready for the finish coat.

FINISH COAT—WHITE*

Bring the putty to the proper consistency for application and trowel to a perfect finish, keeping the surface moist.

FINISH COAT—SAND*

After applying the material, use the brush and float well to cause the surface to present a characteristic sandpaper finish.

†*The following are the proportions in which materials should be mixed at the mixing plant or by the contractor on the job for metal lath—Three coat work.*

Per Ton of Sanded Plaster	Per Hundred Pounds of Hydrated Lime
SCRATCH COAT	
1550 pounds sand	350 pounds sand
450 pounds hydrated lime	100 pounds hydrated lime
4 pounds hair	1 pound hair
BROWN COAT	
1600 pounds sand	400 pounds sand
400 pounds hydrated lime	100 pounds hydrated lime
1½ pounds hair	½ pound hair

FINISH COAT—WHITE

Lime putty properly gauged with Plaster of Paris

FINISH COAT—SAND

1450 pounds sand	275 pounds sand
550 pounds hydrated lime	100 pounds hydrated lime

*Incorporate paragraph referring to either white finish or sand finish, according to finish desired
†These are average mixtures for first class, clean, sharp plastering sand.
Mixtures may be changed to meet other qualities of sand.

Applying to Brick or Tile—Three Coat Work

Where plaster is mentioned, it shall mean a mixture of hydrated lime and sand in proportions and applied as mentioned below.

The hydrated lime shall be of an approved brand and shall pass the Standard Specifications for Hydrated Lime of the American Society for Testing Materials.

Grounds to be ¾" for all brick or tile walls.

SCRATCH COAT

Apply the scratch coat lightly but with sufficient pressure to bond the material to the brick or tile. Scratch the face to strengthen bond for brown coat. When this coat is thoroughly dry, apply the

BROWN COAT

Bring this coat out to the grounds and use the darby and float to form a true and even surface ready for the finish coat.

FINISH COAT—WHITE*

Bring the putty to the proper consistency for application and trowel to a perfect finish, keeping the surface moist.

FINISH COAT—SAND*

After applying the material, use the brush and float well to cause the surface to present a characteristic sandpaper finish.

†*The following are the proportions in which materials should be mixed at the mixing plant or by the contractor on the job for brick or tile—Three coat work.*

Per Ton of Sanded Plaster	Per Hundred Pounds of Hydrated Lime
SCRATCH COAT	
1600 pounds sand	400 pounds sand
400 pounds hydrated lime	100 pounds hydrated lime
1½ pounds hair	⅜ pound hair
BROWN COAT	
1600 pounds sand	400 pounds sand
400 pounds hydrated lime	100 pounds hydrated lime
FINISH COAT—WHITE	
Lime putty properly gauged with Plaster of Paris	
FINISH COAT—SAND	
1450 pounds sand	275 pounds sand
550 pounds hydrated lime	100 pounds hydrated lime

*Incorporate paragraph referring to either white finish or sand finish, according to finish desired

†These are average mixtures for first class, clean, sharp plastering sand.
Mixtures may be changed to meet other qualities of sand.

Applying to Brick or Tile—Two Coat Work

Where plaster is mentioned, it shall mean a mixture of hydrated lime and sand in proportions and applied as mentioned below.

The hydrated lime shall be of an approved brand and shall pass the Standard Specifications for Hydrated Lime of the American Society for Testing Materials.

Grounds to be ¾" for all brick or tile walls.

FIRST COAT

Apply a light coat of plaster, then bring out to grounds by doubling up, using the darby and float to bring to a true and even surface for the finish.

FINISH COAT—WHITE*

Bring the putty to the proper consistency for application and trowel to a perfect finish, keeping the surface moist.

FINISH COAT—SAND*

After applying the material, use the brush and float well to cause the surface to present a characteristic sandpaper finish.

†*The following are the proportions in which materials should be mixed at the mixing plant or by the contractor on the job for brick or tile—Two coat work.*

Per Ton of Sanded Plaster	Per Hundred Pounds of Hydrated Lime
FIRST COAT	
1600 pounds sand	400 pounds sand
400 pounds hydrated lime	100 pounds hydrated lime
1½ pounds hair	⅜ pound hair
FINISH COAT—WHITE	
Lime putty properly gauged with Plaster of Paris	
FINISH COAT—SAND	
1450 pounds sand	275 pounds sand
550 pounds hydrated lime	100 pounds hydrated lime

*Incorporate paragraph referring to either white finish or sand finish, according to finish desired.
†These are average mixtures for first class, clean, sharp plastering sand.
Mixtures may be changed to meet other qualities of sand.